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THE following communications were read :—

I. Remarks on his Fifth Catalogue of Double Stars, communicated to the Society, June 7, 1832. By Sir J. F. W. Herschel.

The present Catalogue is not only more copious than any of the preceding, but contains many more very close double stars.

"Whoever casts his eye down the columns of the Catalogue in question, will not fail to be struck with the occurrence of double stars in which the distance of the individuals (centre from centre) is set down at $1\frac{1}{2}''$, $1''$, $\frac{3}{4}''$, $\frac{2}{3}''$, or even $\frac{1}{2}''$. He will naturally be led to ask, in the first instance, whether I have not in such cases suffered myself to be misled by some optical illusion; and, in the event of all doubt on this point being dissipated, how it happens that with magnifying powers so moderate as those habitually applied to the 20-feet reflector (180, 240, 320, and only in very rare instances 480), it has been able to divide them?

"With respect to the first of these inquiries, it will suffice to shew the *reality* of the observations, and that no illusion has influenced them, if it shall appear that my own and M. Struve's observations—made without previous communication, and each necessarily in ignorance of the other's result—have yet agreed in many very difficult cases, and in some of the most difficult, in assigning as nearly the same relative position to the individuals composing these close objects, as the nature of micrometrical measures in such cases will admit. Granting the possibility of illusion by the reflector giving double images to single stars, *as it occasionally will*, (though such false images may always be *certainly* distinguished from true ones, so that no practised observer, with moderate attention, *can* mistake a star so doubled for a double star), it will not be contended that such illusory images should always assume the same angular situation with respect to the true image, in the observations of two independent observers.

"With a view to this very inquiry, I communicated, some time ago, by letter to M. Struve, my measured angles of position of the following stars :— Σ 305*, 333, 609*, 728, 770*, 1033*, 1093*, 1785*, and 2856*. Of these, the stars marked with an asterisk have no angles of position stated in the Dorpat Catalogue; nor, so far as I know, any where else. Their positions, therefore, could not

by possibility have been known to me at the time I observed them. In reply, in a letter dated March 29, 1832, M. Struve communicated his own measures of the same stars, obtained with the great equatorial; and the following comparison of results will shew their general agreement with mine: —

No. of Star.	Angle of Position observed by Herschel.	Angle of Position observed by Struve.	
Σ. 305*	329°,4	332°,7	
333	195 ,0	188 ,9	ε Arietis.
609*	87 ,0	82 ,4	
728	200 ,6	203 ,8	32 Orionis.
770*	333 ,5	339 ,8	
1033*	282 ,6	282 ,2	
1093*	274 ,1	93 ,2(=273,2−180)	
1785*	163 ,8	164 ,3	
2856*	209 ,8	201 ,0	

"Among these, the stars No. 333 and 1093 are remarkable for their closeness; ε Arietis is described as '*in contactu*' in the Dorpat Catalogue; its distance, in the notes to that work, is stated at 0″,51, and its position is there also (from measurement) set down at 186°,9. Of No. 1093 no measure, either of angle or distance, is given; but M. Struve, in his letter above mentioned, states its distance (which I have estimated as 1″) to be only 0″,57 by actual measurement. In the measured position of this star, we agree within a single degree. No. 770, also, is described in the Dorpat Catalogue as '*vicimissimæ, difficilis*;' and the great inequality of its component individuals will account perfectly well for the difference of 6° 3′ in our measures. The star No. 1785 is comparatively coarse, and was included in the list on account of the peculiar circumstances under which it was observed — viz. when *no* star could be seen by the naked eye for clouds. M. Struve's observation, on the other hand, as he informs me, was made *in the day-time*—no slight proof, it must be confessed, of the optical power of the Dorpat refractor.

"Among the list of objects last set down, there are two which have been noticed as offering an appearance of discs, and have been considered as possible cases of planetary nebulæ. This, however, is a bare suggestion of *possibility*. I do not believe them to be objects of that class: their extreme rarity renders it too improbable. Nevertheless, the case is instructive. In my fourth Catalogue I have already noticed the case of Σ 1883 and *h* 639, in which objects at first suspected to have discs, and taken for planetary nebulæ, proved to be close double stars of the order '*pervicinæ*.' It is here impossible not to call to mind the recent experiments of M. Savart, which have shewn that the sequence of two simple indivisible *noises* — two *points of sound*, as they may be regarded — at an interval of time less than that of the vibrations of the lowest

note on an organ, is sufficient to excite the sensation of a *musical tone*, or continuous sound, just as in the case before us two points of light sufficiently close in respect of space call up the idea of a luminous surface."

Sir J. Herschel then remarks on the necessity of continued investigation of these objects, as exemplified in the case of ι Ursæ, which was not detected as a double star either by Sir W. Herschel or M. Struve, though within the reach of their instruments:—

"The connexion of double stars with nebulæ is a point of high and curious physical interest, and may not impossibly serve as a connecting link by which something more of the mysterious nature of the latter class of objects may ere long become known to us. Several instances of such connexion occur in my Catalogue, among which the more remarkable is *h* 2827. The individuals of this double star are both considerable stars, of a magnitude between the ninth and tenth, and not less than 15″ apart; and they occupy very nearly the foci of the elliptic outline of a nebula of considerable size, its longer axis being about 50″, and pretty bright. Hardly less interesting, though much less conspicuous (being in fact one of the most difficult objects in the heavens), is *h* 2529, where a minute and very close double star forms the nucleus of a small round nebula. One or two other small stars in the immediate vicinity seem unconnected with it; but the exactly central position of the double star strongly points to a physical relation between them. If we compare the descriptions of these objects with those of *h* 367, *h* 749, *h* 2115, and that discovered by M. Struve, Σ 2332, and figured by him in his Catalogue, it will, I think, be admitted that some other account must be given of the connexion between these double stars and their surrounding nebulæ than that of mere casual superposition. I am much mistaken, also, if the nucleus of Messier's sixty-fourth nebula (which is a very large and bright object) be not a close double star: and what renders this (if verified by further observation) particularly remarkable, is the existence, in the immediate neighbourhood of the nucleus, of a considerable vacuity or space comparatively free from nebulous matter, as if a portion had been absorbed into the star."

With regard to the colour of double stars, Sir J. Herschel has observed no instance in which any star (not in the immediate neighbourhood of a larger red, orange, or yellow one) has excited the slightest suspicions of a preponderance of blue or green in its tint; all stars appearing white which do not tend to yellow or red, provided no lamp or candle-light be near. He considers it probable, that when two stars exhibit colours from opposite ends of the spectrum, the blue or green tint is the effect of contrast.

"I have sometimes been asked for test-objects, to try at once the light and distinctness of a telescope under high powers. In such cases it is desirable to select objects which can be certainly *found*, without the possibility of mistake; and in this view I would point out the small double star accompanying β^1 and β^2 Capricorni,

h 2948, or the small double companion of β Equulei, h 3023, as very well adapted for the purpose. A telescope which will shew the *former* of these objects distinctly double, I have no hesitation in saying, must be competent to the most difficult work which any ordinary observer is likely to task it with. No telescope, I ought to add, can be expected to shew the satellites of Uranus (at least in the present low situation of the planet in the ecliptic) which will not stand this test."

II. Observations of the Transit of Mercury of May 4, 1832, made at the Royal Observatory of San Fernando. From Don José Sanchez Cerquero.

These observations were made by MM. Cerquero, Montojo, Hoyos, and Captain Shirreff, R.N., in three different apartments. The sky was cloudless, but the wind and haze caused some difficulty. The telescopes employed were achromatics, by Dollond, of $3\frac{1}{2}$-feet focal length, with triple object-glasses, magnifying power about 80; yet even with this low power the limbs were not steady or well defined.

The means of the results, in time of the standard clock, were,

	Mean Solar Time.		
INGRESS.	h	m	s
External Contact	20	38	33,0
Internal Contact	20	41	41,9
EGRESS.			
Internal Contact	3	23	36,8
External Contact	3	26	53,8

May 5, at noon, clock fast upon mean solar time $3^m\ 3^s,0$; gaining rate, $1^s,615$ a-day.

"At the internal contact, particular care was taken to note the two phenomena seen in the transit of Venus in 1769, or the formation of the black drop (*gutta nigra*) at the contact of the limbs, and the formation of the luminous thread at the separation of the limbs.

"No one of the four observers saw the formation of the luminous thread as an instantaneous phenomenon, or as one which he could note with full certainty, though M. Montojo believed that he saw the drop formed 25^s before the first internal contact. He was not certain of it, and none of the other observers saw it at all. Captain Shirreff believed that he saw the luminous thread at 38^s; but a puff of wind shook his telescope, and he was not certain of the appearance till 40^s."

During the transit, repeated measures were taken of the distance of the planet from the nearest limb of the Sun, by means of a divided object-glass micrometer. As the very high position of the sun rendered the measures by a single observer difficult and fatiguing, the contacts were formed by one observer, and the micrometer read off by another, and *vice versâ*. A careful look-out was kept for the formation of the drop and the instantaneous breaking of the luminous thread; but neither MM. Sanchez nor Shirreff

could see any such appearance, nor was the phenomenon instantaneous.

III. On the Eclipse of the Sun of July 27, 1832, as observed at the Royal Observatory of San Fernando. By Don Sanchez Cerquero.

"The beginning of the eclipse could not be observed with the achromatic telescopes usually employed at the Observatory, on account of the great elevation of the sun. As this circumstance was foreseen, the old equatorial of Dollond was placed on the South Terrace, and the new one in a garret towards the same quarter, with a rotatory conical roof. Don Saturnino Montojo observed the contacts with the former instrument, and Don Sanchez Cerquero with the latter. The time was taken from the regulating clock. The distances between the cusps were measured with the divided object-glass micrometer applied to the new equatorial; and to avoid the loss of time, and inconvenient changes of position, to which the observer would have been liable if the same person had made the contacts and also read the vernier, as the sun had nearly 70° of altitude, one made the contacts while the other read the vernier, and *vice versâ*. The clock-rate was obtained by transits of the stars, the error for the 26th, at midnight, by corresponding altitudes taken by M. Montojo with a Troughton's sextant."

	h	m	s		Eng. Inch.
Beginning of the Eclipse, 2 observers	1	6	10,0	by clock.	Barom.....29,990
Clock fast.....		2	38,57		Exter. Ther. 74°
					Inter. Ther. 87
	1	3	31,43	mean solar time.	
End of the Eclipse, 2 observers.....	3	11	43,25	by clock.	Barom.....29,930
Clock fast.....		2	38,44		Exter. Ther. 76°,5
					Inter. Ther. 85 ,0
	3	9	4,81	mean solar time.	

"The sky was clear during the whole of the eclipse, and the limb of the sun perfectly defined. The wind was fresh from the N.W."

IV. Observations of Biela's Comet, and deduced Elements, by Professor Nicolai, of Mannheim. In a letter from M. Olbers to Sir John Herschel. Communicated by Sir J. Herschel.

The elements deduced by Professor Nicolai are as follow:—

Mean time of perihelion passage at Berlin.....	1832, Nov. 26,09955
Logarithm of perihelion distance	9,8758577
Longitude of the perihelion.....	109° 52′ 55″,1
Longitude of ascending node	248 13 33 ,3
Inclination of the orbit.....	13 10 25 ,2
Logarithm of semi-major axis	0,5486140
Mean daily sidereal motion.....	533″,4400

M. Olbers observes, that these elements coincide very well with those of M. Damoiseau, excepting in the longitude of the perihelion, which difference may perhaps arise from the resistance of a medium.

The comet was not visible in September to M. Harding with a 10-feet reflecting telescope, nor to M. Nicolai with a $4\frac{1}{2}$-feet achromatic by Fraunhofer. Sir J. Herschel first saw it on the 23d of September; it was seen at Rome on the 24th; M. Gambart at Marseilles, and Valz at Nismes, saw it on the 19th of October; M. Bessel on the 20th, and M. Nicolai on the 21st.

M. Olbers forwards the observations of MM. Bessel, Nicolai, and Schwerd.

Encke's comet was seen by M. Mossotti, at Buenos Ayres, on the 2d, 6th, and 7th of June last; and its position agreed remarkably well with the ephemeris, the times of the perihelion differing only by $\frac{1}{100}$ of a day, or half of the same difference in 1828.

V. Stars observed with the Moon at the Royal Observatory, Greenwich, in the months of December 1832 and January 1833.

		Time by the Transit Clock. h m s	Daily losing rate. s
Dec. 15.	δ Virginis	12 47 40,40	
	Moon 2 L.	13 11 53,38	0,95
	Spica Virginis	13 16 53,06	
28.	Moon 1 L.	23 24 32,20	0,71
	(190) Aquarii	23 40 16,18	
Jan. 5.	χ^3 Orionis	5 54 13,06	
	Moon 1 L.	6 45 15,38	0,50
	Moon 2 L.	6 47 45,82	
	q Geminorum	7 12 18,24	
6.	ζ Geminorum	6 54 24,22	
	q ———	7 12 17,54	0,50
	Moon 2 L.	7 55 51,82	
	(42) Cancri	8 10 48,00	
27.	μ Piscium	1 22 21,56	0,62
	Moon 1 L.	1 29 40,62	
30.	(103) Tauri	3 30 53,36	
	Moon 1 L.	4 5 56,20	0,62
	α Tauri	4 27 14,60	
	i ——	4 42 30,82	

VI. Stars observed with the Moon at the Cambridge Observatory, in the month of January 1833.

Jan. 6.	ζ Geminorum	6 53 34,91	
	q ———	7 11 28,01	1,42
	Moon 2 L.	7 55 1,55	
	(42) Cancri	8 9 58,54	
27.	μ Piscium	1 21 21,11	
	Moon 1 L	1 28 39,71	1,30
	α^2 Piscium	1 53 19,39	
	ξ^1 Ceti	2 4 4,18	
28.	ξ^1 Ceti	2 4 2,95	1,40
	Moon 1 L.	2 17 40,86	
30.	(103) Tauri	3 29 50,63	
	Moon 1 L.	4 4 52,52	1,42
	α Tauri	4 25 11,73	
	i ——	4 41 27,89	

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